

WASHINGTON *SCIENCE TRENDS*

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Plasma Acceleration Studies

National Aeronautics and Space Administration (NASA) is studying a new method of plasma acceleration which makes use of the radiation pressure of microwaves for possible application in simulation of micrometeorites, propulsion and thermonuclear fusion.

- * Method: Success of the new method is said to depend on the recent development of microwave generators of extreme power outputs, in the area of 100 megawatts. NASA studies indicate that the radiation pressures attainable with such high powers can be further increased by storing the radiation by resonance in a cavity -- bounded on one side by the plasma.

When the plasma moves, the input frequency of the standing wave is changed, which in turn changes the dimension of the cavity. The radiation, when used to accelerate the plasma, is compared to a gas. However, the gas is almost free of inertia and can expand with a velocity approaching the velocity of light.

- * Efficiency: NASA studies indicate that although the energies that can be stored in the cavity do not yet quite measure up to acceleration systems where the energy is stored in condenser banks, it is believed that the efficiency of interaction of the radiation with the plasma could be superior to other systems. This means that it could be possible to accelerate plasmas of small masses to higher velocities.
- * Advantages: Several aspects of the NASA method are said to appear promising, when compared with other systems for plasma acceleration and thermonuclear fusion. The problem of contamination of the plasma is avoided since the energy can be more or less focussed in certain regions. The method is also said to eliminate certain difficulties experienced when a plasma is accelerated by induction effects due to a moving magnetic field, as well as losses experienced due to the so-called skin effect in certain fusion test devices.

(Studies by Robert V. Hess and Karlheinz Thom, Langley Research Center, NASA, Langley Field, Va.)

Editor's Note: Washington SCIENCE TRENDS will reach you a day or two later during the next two weeks, because of the Holidays. Issues will be dated and mailed Dec. 28 and January 4.

Cosmic Ray Balloon Flights

Navy and the National Science Foundation hope to launch two ten-million cubic foot balloons from the aircraft carrier Valley Forge in late January in a study of very high energy cosmic rays. The skyhook balloons, supplied by Winzen Research Inc., are expected to carry 2,500 pound payloads, including an 800-pound block of emulsion, somewhat similar to that used in photographic film.

Emulsion blocks, made in England by the Ilford Co., are designed to record primary cosmic rays or nuclear particles that achieve energies as high as 10,000 Bev. National Science Foundation says that there is no satisfactory explanation of particle behavior at these extremely high altitudes, of 100,000 to 120,000 feet, over the Caribbean.

Since the blocks are actually stacks of emulsion sheets it is expected that the nuclear events can be traced in three dimensions, and that the entire chain of secondary interactions started by each primary particle can be traced. Blocks will be processed by the University of Chicago.

Color Television Research

Navy research on transparent luminescent screens has resulted in development of a novel closed-circuit television system with a number of potential applications in the instrumentation, data display and entertainment field.

***System:** The system, as presently developed consists of a color wheel in front of a camera, synchronized by a commutator and high-voltage modulator to the accelerating voltage in a layered, tricolor display tube. The frame sequential system is employed, with the tube mounted on a conventional black and white television chassis, raising the possibility that simple conversion of existing black and white home television may someday be feasible.

***Tricolor Screen:** Each layer on the luminescent screen is deposited and fired to its proper temperature before the succeeding layer is applied. Under bombardment by a beam of electrons a calcium tungstate layer is excited to blue luminescence, a magnesium fluoride layer is excited to red and a zinc orthosilicate is excited to green. There is also an aluminum layer which is opaque and serves to increase brightness, and a zirconium silicate layer which helps to preserve the color purity of both the red and green luminescence. The screen is mounted next to the face of the cathode tube and about a half inch from a 250-mesh grid of 70 percent transmission, which serves to maintain the image size.

***Development:** A two-color dual beam cathode ray tube for instrumentation purposes and military applications is expected to be available commercially during 1961. Production of the two-color screen on a commercial basis is expected shortly. Navy researchers admit that the tri-color components are "rather unsophisticated" at this time but believe that the principles involved are established well enough to warrant further development. One change indicated would be the use of a photocell arrangement on the color wheel in place of the commutator.

(R&D by Crystals Branch, Solid State Division, U.S. Naval Research Laboratory, Washington 25, D.C.)

Radio Noise Characteristics

Prediction of radio noise characteristics under various conditions throughout the radio frequency range is said to be simplified by a new graphical method developed by the National Bureau of Standards.

- * Present Techniques: At present, noise predictions can be derived from an amplitude-probability distribution in which voltage levels are plotted against the percentage of time these levels are exceeded. However, NBS points out that this method requires detailed measurements at all frequencies and at many locations. Continuous routine measurements are said to be virtually impossible because of the complex equipment and the large number of personnel required.
- * Empirical Graphical Method: The NBS technique requires only measurement of three statistical moments -- the average noise power, the average envelope voltage, and the average logarithm of the envelope voltage. From these, four parameters can be derived to describe completely the amplitude-probability distribution. This is plotted on a special graph paper designed so that the so-called Rayleigh distribution of thermal noise plots as a straight line. The curve, according to NBS, is the usual plot of voltage in decibels against the percentage of time the level is exceeded.
- * Accuracy: NBS researchers checked the numerically integrated moments by comparing them with moments which had been recorded at the same time as the distributions. Approximately 60 sets of distribution measurements were analyzed to determine the error, which was attributed mainly to the recorder. The standard deviation in the root mean square voltage values was about 1.1 decibels, with an average error of -0.4 decibels.
- * Limitations: The Bureau points out that this method is valid only for the bandwidths in which the moments were measured. However, a study is now in progress to develop an accurate method of bandwidth conversion.

Ionosphere Study

National Aeronautics and Space Administration is sponsoring a 1960 study of ionospheric conditions in the subarctic which cause a scintillation or "twinkling" of radio signals from earth satellites.

A University of Illinois team will establish a radio listening post in Northern Canada to confirm theories concerning an extensive area of "patches" of varying electron density. It is believed that these patches are at about 120 miles altitude, and begin at about 40 degrees north latitude in the auroral zone.

Recordings will be checked against those simultaneously made by the University's satellite tracking station in Central Illinois.

Ice Adhesion Research

Prevention of ice adhesion is being studied by the Navy, in a program which is expected to have important applications for aircraft, railways, roads, high-tension wires, submarine snorkels and ship surfaces.

Object of the program is a permanent or semi-permanent surface coating that will discourage or prevent ice-adhesion, or simplify removal. An ice adhesion apparatus has been designed and constructed and a simple, reliable test method has been developed. Measurements are made in terms of stress in pounds per square inch required to shear the ice horizontally from a surface.

Materials, to be considered, must remain below 15 pounds per square inch on repeated ice releases, with water immersion between ice releases. In addition, tests are made of 50 trials with no water immersion between ice releases.

Most promising coating currently under investigation is reported to be of the poly-siloxane class. This coating has withstood more than 60 cycles of water immersion before failure of film integrity. Ice adhesion values are said to be in the range of 2 to 30 pounds per square inch. Tests are continuing in hopes of perfecting a coating that will successfully withstand icing aboard ship, and will provide ice adhesions low enough to facilitate ice removal for several weeks.

(R&D by Material Laboratory, New York Naval Shipyard, N.Y.)

Oceanography Program

Robert G. Snider will serve as Coordinator of the forthcoming International Indian Ocean expedition which will conduct basic research in physical and chemical oceanography, meteorology, marine biology, geophysics and submarine geology. An office has been established at 30 East 40th St., N.Y.C., N.Y.

Wright Air Development Division

Air Force has discontinued the Wright Air Development Center and Headquarters, Air Research and Development Command's Directorate of Systems Management, both at Wright Patterson Air Force Base, Ohio. Elements of each office have been incorporated into a new Wright Air Development Division.

WADD will have primary Air Force responsibility for planning, programming and managing the development of so-called "military aerospace systems." This includes aircraft, aerodynamic missiles, missiles associated with aircraft, manned "aerospace systems" and support systems, and for advancing the technology required for development of these systems.

Key positions include: Directorate of Systems Management - Brig. Gen. Joseph R. Holzapple; Directorate of Systems Engineering - Col. Fred J. Ascani; Directorate of Advanced Systems Technology - Col. Albert L. Wallace, Jr. Vice Commander will be Col. Wm. R. Grohs; Chief Scientist, John E. Keto and Chief of Staff, Col. Raleigh H. Macklin.

Research Checklist

- () Lens Distortion Measurement: Studies sponsored by the Air Force indicate that any of four separate methods can provide high accuracy in the measurement of distortion in photogrammetric lenses. The methods can be relied upon to predict lens performance, or to verify the accuracy of any of the other methods, it was reported. Latest tests proved the feasibility of both an inverse nodal slide and a modified goniometric technique.

(Details available. Single copies free. Write National Bureau of Standards, Office of Technical Information, Washington 25, D.C. for STR - 2423)

- () Three-Pole Magnet: A three-pole magnet, said to be unique, is being used at the University of Michigan in studies sponsored by the armed services. The device is designed for basic research on how magnetism affects magnetic materials, which in turn affect microwaves. The tri-polar magnet is said to be an aid in aligning the crystals of magnetic materials used as circuit elements.

(R&D by Electrical Engineering Department, University of Michigan Research Institute, Ann Arbor, Mich.)

- () Dielectric Soybean Measurements: U.S. Department of Agriculture finds "reasonably successful" an electronic device designed to measure the oil content of soybeans. However, the Department believes that further refinements are necessary before the unit is put into general use as a means of paying producers on the basis of oil content.

(Report available. Single copies free. Write Office of Information, U.S.D.A. Washington 25, D.C. for Marketing Research Report 367)

- () Fluorine Compound Preparation: Studies sponsored by the Air Force Office of Scientific Research are said to have resulted in a new method for preparing fluorine compounds by radiation. A mixture of aromatic hydrocarbons and fluorocarbons is exposed to high energy radiation and the compounds can then be separated from other material by standard laboratory methods such as distillation. The process is said to have potential value in the munitions field and in the improvement of lubricating, hydraulic fluids and plastic materials.

(R&D by Dr. Paul Feng, Armour Research Foundation, Illinois Institute of Technology, Chicago 16, Ill.)

- () Flight Data Entry Device: Federal Aviation Agency has initiated test and evaluation of FLIDEN (Flight Data Entry) equipment as an air traffic control aid. Units, by Aeronutronic Division Ford Motor Co., are to be used principally in the composition of flight plans for entry into FAA air traffic control computers and data processing devices. The units employ a magnetic drum for storage and read-out, and a cathode-ray tube for display of the message being composed. FAA says this permits the operator to type in only the variable items of the flight plan. The device is said to be highly flexible in the area of error detection and correction.

Publication Checklist

- () Basic Scientific and Astronautic Research, testimony delivered in June 1959 by research and development officials of the Army, Navy, Air Force and other defense agencies. Now released with some security deletions. 536 pages. Single copies free. (Write Committee on Science and Astronautics, U.S. House of Representatives, Washington 25, D.C., for Hearings, No. 45)
- () Federal Funds for Science, a new report with many graphs and related material on the Federal Research and Development Budget for the 1958, 1959 and 1960 Fiscal Years. 74 pages. 45 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C., for Publication NSF-59-40)
- () Post Office Patents, a critical Congressional report on the handling of patents growing out of development work sponsored by the Post Office Department. 6 pages. Single copies free. (Write Patents Subcommittee, Committee on the Judiciary, U.S. Senate, Washington 25, D.C.)
- () Military Technology and Foreign Policy, a study by Johns Hopkins University on developments in military technology and their impact on U.S. Strategy and Foreign Policy, including a critical analysis of many present-day weapon systems. 120 pages. Single copies free. (Write Committee on Foreign Relations, U.S. Senate, Washington 25, D.C.)
- () Energy Resources and Technology, a transcript of statements, testimony and exhibits on present-day and future prospects for a variety of power and energy sources. An excellent reference work in this field. 352 pages. Single copies free. (Write Subcommittee on Automation and Energy Resources, Joint Economic Committee, U.S. Congress, Washington 25, D.C. for Hearings - Energy Resources)
- () Atomic Agreement, a transcript of statements, testimony and exhibits relating to the agreement for cooperation with the United States and the International Atomic Energy Agency. 93 pages. Single copies free. (Write Joint Committee on Atomic Energy, F-88, The Capitol, Washington 25, D.C. for IAEA Hearing)
- () Fabrication of Tungsten, a report for the Defense Department by the Defense Metals Information Center, Battelle Memorial Institute which is designed to serve as a technical introduction to the problems of tungsten fabrication. 65 pages. \$1.75. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for PB 151 071)
- () Yttrium Extraction, a report presenting three simple and rapid procedures for extracting yttrium and rare-earth elements from a euxenite carbonate. Dilute sulfuric acid is used as the solvent. 15 pages. Single copies free. (Write Publications Distribution Section, U.S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Report of Investigation No. 5521)

